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Energy level crossing and high-field magnetization in HoVO_4

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The magnetic properties of the tetragonal rare-earth zircon HoVO_4 with crystal-field singlet ground state have been investigated by magnetic susceptibility and high-field magnetization measurements up to 28 T using the hybrid magnet at NRIM. Magnetic susceptibility of the single crystal HoVO_4 shows quite anisotropic behavior for the easy ab -plane and the hard c -axis. Temperature dependence of the magnetic susceptibility shows Van Vleck behavior in lower temperatures than the first excited energy of 30K. Magnetization process along the [001] axis shows an abrupt increase more than $8 \mu_B$ at 11.5 T. This enormous magnetization jump is explained in terms of the level crossing effect between the non-magnetic ground state and the excited one which include mainly $J_z = -7$. Magnetization along the [110]- and [100]-axes increase gradually because the level crossing is not expected in these field directions. Temperature dependence and magnetization process along the three principal axes are well reproduced by crystal-field level previously reported.